



## **Work in Progress: The RISE Seminar and the Influence it has on Underrepresented Students in STEM**

**Dr. Ellise M. LaMotte, Tufts University**

Ellise LaMotte is the Director of the Center for STEM Diversity at Tufts University. She received her Ph.D. in Education from the University of Massachusetts Boston and focuses her research on underrepresented populations in STEM disciplines in institutions of higher learning.

# **Work in Progress: The RISE Seminar and the Influence it has on Underrepresented Students in STEM**

## **Abstract**

This Work in Progress document will describe the design process that will be used to examine the influence the Redefining the Image of Science and Engineering (RISE) seminar has on first year underrepresented students in STEM majors, starting with data collection. RISE is a first year advising seminar, intended for first-generation and underrepresented students in the STEM disciplines. The goals of this RISE seminar are to: familiarize the students with their college surroundings, bolster their sense of belonging, develop their identity as a scientist or engineer and provide them with tools that will prepare them to excel academically. With these goals in mind, we want to examine the students' experiences through phenomenological inquiry as well as analyze their academic background (Input) their college experience (Environment) and grades earned (Output) using the Input-Environment-Output model [1]. This analysis will assist in determining the influence the RISE seminar has on the students as it provides tools and experiences to assist them on their academic journey compared to the experiences and I-E-O data for students who do not participate in RISE.

## **Purpose of WIP**

The purpose of this Work in Progress paper is to begin the process of developing the framework that will be used to analyze the RISE first year seminar through an overarching theoretical framework focused on phenomenological interview data and student focused analytical data. Ultimately, this information will inform the researchers and the RISE first year seminar instructors, enabling them to improve upon the RISE first year seminar, obtain data to prove its effectiveness, as well as develop strategies to offer it to more underrepresented students interested in STEM. Additionally, this research could inform the methods by which other first year programs support students as they move through their first year of college.

## **Introductions**

Redefining the Image of Science and Engineering (RISE) is a first year academic advising seminar designed to support first-generation and underrepresented, academically talented students pursuing degrees in science and engineering. RISE scholars receive advising, mentorship, and academic credit for participation in weekly classes that focus on academic success strategies, navigating college life, building relationships with faculty, and professional networking. Through these activities along with participation in social events and community-building activities, including company visits and lab tours, RISE scholars become members of a community comprised of successful STEM students.

According to the literature, academic accomplishments of underrepresented students in STEM are improved by several influences. One influence is academic preparedness through learning and the path by which students have been educated. The curriculum's intensity and quality is a collaborative, yet lengthy effort, taken on by schools, students and teachers to provide preparation into higher education as well as other academic experiences beyond [2]. Two

additional influences are student engagement through college classroom learning communities [3] and high impact activities [4]. Moreover, an environment that uses these influences is one that demonstrates a practice of democracy, creates a caring atmosphere, is dialogic, utilizes an innovative curriculum and is an effective change agent [5].

High impact activities, such as first year seminars, that demonstrate these traits can propel students toward academic success, self-efficacy [6] and a sense of belonging [4]. According to Badura, self-efficacy is defined as “people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives” [6]. Additionally, a sense of belonging “refers to a students’ perceived social support on campus, a feeling or sensation of connectedness, and the experience of mattering or feeling cared about, accepted, respected, valued by, and important to the campus community or others on campus such as faculty, staff and peers” [7]. Due to these outcomes, the addition of the first year seminar is becoming increasingly more common in colleges and universities and--when implemented well--offers a robust focus on critical thinking, opportunities for writing proficiency, collaborative learning, and the ability to obtain and process information. Together, these elements work to develop students’ academic and applied capabilities. Moreover, high impact classes like a first year seminar lend themselves to an exceptional first year experience [4].

Programs focused on academic preparedness, self-efficacy and a sense of belonging are necessary for underrepresented STEM students as they pursue academic excellence [8]. In the RISE first year seminar, the goal is to develop and implement a seminar with these foci: strengthening academic preparedness, providing scholars with tools for better learning, introducing campus support, and growing the scholars’ sense of belonging and self-efficacy on campus and in STEM. Jensen posits that a sense of belonging and a social connectedness to the campus community are important factors affecting academic success [9]. Additionally, perceived self-efficacy, is important to students’ academic progress [6].

With these factors and goals in mind, we are designing a research study that will examine the first year RISE seminar and its components. These research conclusions will provide information allowing for program improvement and expansion. The findings can also provide insights that can be used to inform other programs that support undergraduate students.

### **Research questions:**

1. How does the RISE first year seminar impact academic success, sense of belonging and self-efficacy for the RISE Scholars?
2. What significant differences exist in the student experience and academic success based on participation in the RISE first year seminar as we compare underrepresented scholars who participated in the RISE first year seminar and those who do not.

To answer these questions, we will employ a parallel formed [10] mixed method approach, collecting both qualitative and quantitative data to examine the students’ experiences through phenomenological inquiry, obtaining their voice and narrative, and by analyzing the academic

background (Input) the college experience (Environment) and the grades received (Output) using the Input-Environment-Output model [1]. This mixed method study will analyze influences the RISE first year seminar provides to students on their academic journey and compare their academic journey to students who did not participate in RISE.

## **Background**

Tufts University established the Center for STEM Diversity (CSD) in 2008, in partnership with the School of Engineering and the School of Arts and Sciences to foster a diverse and inclusive science and engineering learning environment. The goals of the CSD are to develop best practices for recruiting and retaining underrepresented undergraduate and graduate students; work with faculty and staff to accomplish diversity-related goals and foster a diverse and inclusive STEM community.

The CSD team focuses on strengthening meaningful student participation in science and engineering, specifically for traditionally underrepresented groups including, women, African Americans, Native Americans, the LGBTQ community, and those who identify as Hispanic and/or Latinx. The CSD also work intentionally with first-generation college students and with students from low-income backgrounds. From these goals and commitments, programs such as the RISE first year seminar were developed.

The RISE first year seminar started as PRiSE, Promoting Retention in Science and Engineering, in the 2013 academic year. Students joined PRiSE to build community, receive mentorship, tutoring, and academic advising as well as be supported by the Center for STEM Diversity. Since its inception, PRiSE has transformed into RISE, the program it is today. During this transformation, RISE has grown into an official Registrar approved two-semester seminar course with a curriculum focused on building a cohort of students who can support one another as they build their sense of belonging, self-efficacy and academic expertise. In creating and implementing this first year seminar, it is important for the cohort to include both students interested in science majors as well as those interested in engineering majors because students are in either the School of Engineering or the School of Arts and Sciences. This inclusion allows students to meet peers they would not normally interact with. This cohort model enables students to broaden their perspectives as they potentially encounter students with interests different from their own.

The RISE first year seminar is now offered in the fall and spring semesters, as a year-long opportunity for a cohort of s 25-30 students. The fall semester focuses on academic preparedness and acclimates students to their college environment by introducing them to faculty and support offices on campus like the Academic Resource Center, Career Services, Advising and Financial Aid. The RISE scholars also participate in the Guaranteed 4.0 program, consisting of four interactive seminars. According to the founder, Donna O. Johnson Mackey, “The focus of these seminars is not “how to study. Rather, we want students to learn how to learn and ultimately achieve a mindset of academic excellence and success.” Using this comprehensive framework, students learn simple strategies such as repetition for long-term information retention, as well as more complex strategies focused on critical thinking and metacognition [11].

The spring semester presents the scholars with opportunities to discover some of the connections between their interests and goals, and the academic work they will accomplish during their time at Tufts. They have the opportunity to reflect and discuss topics including, but not limited to discerning their major, exploring Study Abroad program options and applying for internships. They also spend time discovering different forms of research and talking with faculty about their experiences with research. Additionally, the scholars hone their writing, producing a personal statement, updating & polishing their resume and cover letters, as well as perfecting the manner in which they verbally express their goals and accomplishments.

Since its inception, the RISE cohort has grown as the Center for STEM Diversity works with Admissions to determine which students will be invited to participate in the RISE Seminar. Once students have accepted their offer into Tufts, Admissions develops a list of the self-identified students who are underrepresented in STEM. This list is provided to the Center for STEM Diversity, and the students are invited to participate in the seminar. Once students express their interest, the co-instructors, select the students ensuring that the RISE Seminar cohort is evenly distributed as it pertains to gender, race, school and major, etc.

Moreover, as the RISE first year seminar developed it was important to include the STEM advising team in the process. To this end the instructors act as first year advisors and work with two deans of advising, one from the School of Engineering and the other from the School of Arts and Sciences. The deans participate in some of the RISE first year seminar sessions and directly advise the RISE scholars. Additionally, the RISE first year seminar has caught the attention of the Tufts President, Provost and Deans of the Engineering and Arts and Sciences schools, manifesting into a fall seminar session whereby this team of four leaders meets with the students. This is one of the most powerful fall RISE first year seminar meetings: first because the four top leaders commit their time to talk with the RISE Scholars and second, the President, Provost, and Dean of the School of Engineering all have STEM degrees, thus immediately resonating with the students. Sessions such as this help to develop a sense of belonging, which is essential to the academic success of underrepresented students in STEM [12].

To this end and through dynamic programmatic offerings, the RISE first year seminar aims to: provide students with opportunities to pair-share, participate in networking sessions, present their passions, met with RISE alumni and Tufts leadership, create personal statements, all to develop the students' sense of belonging, self-efficacy and self-advocacy

### **Theoretical Framework**

The conceptual guide used for this study will consist of the Input-Environment-Output model put forth by Astin [1]. This model is useful because it enable the researchers to use student focused data to assess the academic success of these underrepresented college students in STEM. The input to be focused on are the students' high school classes taken, extra-curricular academic activities, and high school grades received. The college experience will then be evaluated as the environment in this analysis and finally, the output or knowledge the students attained by way of their grades and GPAs will be explored. This data is important, however, not complete unless the students' voices and narratives are included in the analysis. To this end, phenomenology will

be introduced and students will be interviewed, enabling them to provide the narrative to the phenomenon of their experience in this RISE seminar and new college / STEM environment.

Phenomenon, developed from *phaino*, means “bring to light, to place in brightness, to show itself in itself, the totality of what lies before us in the light of day” and phenomenology will enable us to “bring to light” the experiences of underrepresented students as they experience the new college environment and participate in the RISE first year seminar [13]. Phenomenology is a qualitative research methodology that allows the researchers to make meaning of a phenomenon, (in this case, the involvement in the RISE seminar in a new environment) experienced by numerous individuals, while at the same time, describing the commonalities of these experiences [14]. Thus, the interview questions will be focused on the students’ experiences in RISE (or not in RISE) and at Tufts University.

The integration of the the I-E-O data and the narrative of the student voices will provide the researchers and eventually the readers with a robust analysis and a better understanding of the the student academic experience and the influence the RISE seminar had on it. The I-E-O data will allow the researchers to evaluate academic progress and success. Additionally, the phenomenological narratives will provide the context by which these students make meaning of their experiences, sense of belonging, and self-efficacy as they participate in the RISE seminar and the Tufts community. I-E-O data as well as phenomenological data will also be collected from underrepresented students in STEM who did not participate in the RISE seminar to determine if there are any differences and what these difference may be as they pertain to the students’ experience and academic outcomes.

### **Data Collection Process and Analysis**

This research project will begin with IRB approval, allowing the researchers authority to perform research with human subjects. Once secured, the researchers will invite students to participate. The populations involved in this study will consist of RISE Scholars and non-RISE Scholars from Tufts University as they travel through their first year to senior year at Tufts University. All the students invited to participate in the study will possess equivalent entrance scores and will be underrepresented in science, technology, engineering and math (STEM).

Students will receive an email inviting them to participate in this research in the beginning of their first academic year. Once they agree, they will be asked to participate in two one-hour interviews and will be interviewed twice annually. The second interview will enable the researchers to probe deeper with follow-up questions after reviewing the responses from the first interview. Pre-college data will be analyzed, and college grade data will be reviewed annually after being de-identified. This information will be used to compare students who participate in RISE to those who do not.

During the initial conversation, the researchers will introduce the study to students and ask them if they are interested in participating. If students are willing to participate, they will review and sign a consent form after it is explained, and all questions are answered (by the researchers). The students interested in participating in the study will receive a \$25 gift card for their time and effort each year. In the sophomore, junior, and senior years, the researchers will remind the

participating students about the research via email and ask if they are still willing to participate. If so, then the research process will continue.

The two annual hour-long one-on-one interviews will be audio-taped and transcribed to ensure accuracy. During the taping, the students' names will have already been changed to a pseudonym to protect their identity. The audio footage will be kept in a password protected locked file on the Tufts research drive created for this research, along with the transcript of the audiotape. Only the researchers will have access to the data associated with this research project.

As the data is obtained, the researchers will transcribe the interviews and analyze the data to find trends, along with comparisons between the RISE and non-RISE scholars. Annual findings will be developed, and final findings will be constructed at the end of the scholars' academic four years. This process will continue for each RISE cohort to produce longitudinal analysis. Student data such as high school classes taken, participation in high school and college academic extra-curricular activities, high school and college grades received, and college courses taken will also be examined. The responses from the interview question will help to inform the student quantitative data and give a voice to the students and their experiences.

### **Sample Research Interview Questions for RISE Students**

1. What does a sense of belonging mean to you, while you are in this academic environment?
2. Do you feel a sense of belonging here at Tufts University and if so, what helps you to feel this way? If you do not have a sense of belonging what do you think is missing?
3. How has the RISE first year seminar developed your sense of belonging here at Tufts University, if at all?
4. Please tell me about the campus support mechanisms that you are aware of and that you use for academic and/or emotional support.
5. Do you feel more secure in being able to advocate for yourself after being here at Tufts for the time you have been here?
6. If at all, how do you utilize your RISE cohort members? Why do you utilize them (if you do) and why don't you utilize them (if you do not)?
7. How has the the Guaranteed 4.0 program and its associated learning tools supported or hindered your academic success? If it supported you, what were the specific learning tools/strategies you used?
8. Did RISE assignments, (reflection papers, personal statement, and obsession genogram, for example) assist you in developing your science identity and ability to articulate your academic achievements and goals? If so, how and if not, why not?

9. As you participated in RISE, what RISE seminar activities assisted you in having more academic success and making you feel a more significant sense of belonging?
10. Have you participated in any activity or program that has helped to bolster your sense of belonging and self-efficacy? If so, what was the activity or program?
11. How has this activity or program bolstered your sense of belonging and self-efficacy?

### **Sample Research Interview Questions for non-RISE Students**

1. What does a sense of belonging mean to you, while you are in this academic environment?
2. Do you feel a sense of belonging here at Tufts University and if so, what helped(s) you to feel this way? If you do not have a sense of belonging what do you think is missing?
3. Do you have a cohort of students you receive support from and or supply support to, whether the support is academic or emotional/social? If yes, how did you develop this cohort?
4. Do you feel more secure in being able to advocate for yourself after being here at Tufts for the time you have been here?
5. Please tell me about the campus support mechanisms that you are aware of and that you use for academic and/or emotional support.
6. What does a sense of belonging mean to you, while you are in this academic environment?
7. Have you participated in any activity or program that has helped to bolster your sense of belonging and self-efficacy? If so, what was the activity or program?
8. How has this activity or program bolstered your sense of belonging and self-efficacy?

### **Discussion and Conclusion**

The RISE first year seminar has been provided to first year students for three years, and is believed to be effective and should be evaluated. With this notion, this research seeks to determine: the specific tools that assist students, how students feel about their existence at Tufts, how the program can be expanded to support more students as they strive for academic excellence, and the lessons learned that can be used in other programs that support first year underrepresented students in STEM.

The literature reviewed posits that a sense of belonging and self-efficacy are important ingredients to the academic success of students and in particular, underrepresented students in STEM. With this study the researchers' goal is to add to this literature and provide more suggestions and conclusions focused on underrepresented students in STEM, their experiences and their academic success.

Future research questions on this topic could concentrate on other, more specific environmental factors such as faculty and student interactions as well as the methods by which the RISE seminar can be offered to more students and used to inform other support programs. To that end, and during this study the researchers would like to analyze the ways in which RISE seminar best practices can be expanded to support more underrepresented students at Tufts University to ultimately continue broadening participation in STEM fields.

## References

- [1] A. Astin, "Student involvement: A developmental theory for higher education". *Journal of College Student Personnel*, vol. 25, pp. 297-306, July 1984.
- [2] C. Adelman, *Answers in the toolbox: Academic intensity, attendance patterns, and bachelor's degree attainment*. Washington, DC, Department of Education, Office of Educational Research and Improvement, 1999.
- [3] C. Zhao, G. Kuh, "Adding value: Learning communities and student engagement". *Research in Higher Education*, vol. 45(2), pp. 118-138, March 2004.
- [4] G. Kuh, *High-Impact Educational Practices: What They Are, Who Has Access to Them, and Why They Matter*. Washington, DE: Association of American Colleges and Universities, 2008.
- [5] O. Lenning and L. Ebbers, *The Powerful Potential of Learning Communities: Improving Education for the Future*. ASHE-ERIC Higher Education Report. Washington, DC: ERIC Clearinghouse on Higher Education, 1999.
- [6] A. Bandura, *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall, 1986.
- [7] T. Strayhorn, *College students' sense of belonging: A key to educational success for all students*. New York: Routledge, 2018.
- [8] R. Koch, et al., "Enhancing Learning Power through First year Experiences for Students Majoring in STEM Disciplines". *The Journal of STEM Education: Innovations and Research*, vol. 19(1), pp. 22-30, Feb. 1984.
- [9] U. Jensen, "Factors influencing student retention in higher education. Summary of influential factors in degree attainment and persistence to career or further education for at-risk/high educational need students". *Pacific Policy Research Center. Honolulu, HI: Kamehameha Schools—Research & Evaluation Division*. Available: [http://www.ksbe.edu/\\_assets/spi/pdfs/Retention\\_Brief.pdf](http://www.ksbe.edu/_assets/spi/pdfs/Retention_Brief.pdf). [Accessed March 20, 2020].
- [10] D. Mertens, *Research and evaluation in education and psychology*. Thousand Oaks, CA: Sage, 2010.
- [11] D. Johnson-Mackey, Guaranteed 4.0 Program Overview. Available: <http://www.guaranteed4.com/content/pdfs/Guaranteed4-Program-Overview-2011-Edition.pdf>, 2020. [Accessed Feb.2, 2020].
- [12] L. Hausmann, J. Schofield, & R. Woods, "Sense of belonging as a predictor of intentions to persist among African American and White first year college students". *Research in higher education*, vol. 48(7), pp. 803-839, Nov. 2007.

[13] M. Heidegger, “The age of the world picture”, in *Science and the Quest for Reality*, London: Palgrave Macmillan, 1977, pp. 70-88.

[14] J. Creswell, “Qualitative Inquiry & Research Design Choosing Among Five Approaches”. Thousand Oaks, CA: Sage Publications, 2007.